CLAIMS

1. A reactor system for use in the production of methanol from synthesis gas comprising:

   (a) a first reactor adapted to be maintained under methanol synthesis conditions having inlet means for supply of synthesis gas and outlet means for recovery of a first methanol-containing stream, said first reactor being charged with a first volume of a methanol synthesis catalyst through which the synthesis gas flows and on which in use, partial conversion of the synthesis gas to a product gas mixture comprising methanol and un-reacted synthesis gas will occur adiabatically; and

   (b) a second reactor adapted to be maintained under methanol synthesis conditions having inlet means for supply of the gaseous first methanol-containing stream, outlet means for recovery of a second methanol-containing stream and cooling means, said second reactor being charged with a second volume of a methanol synthesis catalyst through which the gaseous first methanol-containing stream flows outwardly from the inlet means and on which, in use, further conversion of the synthesis gas to a product gas mixture comprising methanol will occur.

2. A reactor system according to Claim 1 wherein the first and second reactors are located in separate reactors and the outlet means of the first reactor is connected to the inlet of the second reactor.

3. A reactor system according to Claim 1 wherein the first and second reactors are located within a single reactor.

4. The reactor system according to any one of Claims 1 to 3 wherein the catalyst volume of the first reactor is arranged as a horizontal volume.

5. The reactor system according to any one of Claims 1 to 4 wherein the depth of the first catalyst volume is preferably less than its horizontal dimensions.

6. The reactor system according to any one of Claims 1 to 5 wherein the first reactor additionally includes an inlet gas distributor.

7. The reactor system according to any one of Claims 1 to 6 wherein the second volume of catalyst is arranged such that the product stream from the first reactor flows radially from a central inlet through the second catalyst volume to an outlet collector located at a reactor wall.

8. The reactor system according to any one of Claims 1 to 7 wherein the cooling of the catalyst in the second reactor is provided by water cooling in tubes which pass through the catalyst bed.

9. The reactor system according to any one of Claims 1 to 8 additionally including apparatus to enable the steam produced by the water cooling to be used to drive a compressor. which may be present to increases the pressure of the feed or recycle synthesis gas prior to its addition to the first reactor.

10. A plant for the production of methanol from a synthesis gas mixture comprising carbon oxides, hydrogen and methane comprising:
    (a) a methanol synthesis zone including the reactor system according to any one of Claims 1 to 9; and
    (b) a methanol recovery zone, adapted to be maintained under methanol recovery conditions, for recovery of a crude methanol product stream from the product gas mixture, and for recovery of a vaporous stream comprising un-reacted material of the synthesis gas.

11. The plant according to Claim 10 additionally including:

(c) means for recycling at least a portion of the un-reacted material of the synthesis gas to the methanol synthesis zone.

12. The plant according to Claim 10 or Claim 11 comprising a plurality of reactor systems according to any one of Claims 1 to 9.

13. The plant according to Claim 12 wherein the plurality of reactor systems are located in parallel or in series.

14. The plant according to any one of Claims 10 to 13 wherein the synthesis gas mixture is produced from a hydrocarbon feedstock material in plant comprising a steam reforming zone, adapted to be maintained under steam reforming conditions and charged with a catalyst effective catalysis of at least one steam reforming reaction, for steam reforming of a vaporous mixture of the hydrocarbon feedstock in the steam to form a synthesis gas mixture comprising carbon oxides, hydrogen and methane.

15. A process for producing methanol from a synthesis gas comprising:

(a) supplying the synthesis gas mixture to the methanol synthesis reactor system of any one of Claims 1 to 12 maintained under methanol synthesis conditions;

(b) recovering from the methanol synthesis reactor system a product gas mixture comprising methanol and an un-reacted material of the synthesis gas mixture;

(c) supplying material of the product gas mixture to a methanol recovery zone maintained under methanol recovery conditions; and

(d) recovering from the methanol recovery zone a crude methanol product stream and a vaporous stream comprising un-reacted material of the synthesis gas mixture.

16. A process according to Claim 15 additionally including the step of recycling the un-reacted material to the methanol synthesis reactor.

17. The process according to Claim 15 or Claim 16 wherein the synthesis gas is formed from a hydrocarbon feedstock in a process comprising contacting a vaporous mixture comprising the feedstock and steam in the steam reforming zone with a catalyst effective for catalysis of at least one reforming reaction and recovering from the reforming zone a synthesis gas mixture comprising carbon oxide, hydrogen and methane.

18. The process according to any one of Claims 15 to 17 wherein the synthesis gas is compressed before being supplied to the methanol synthesis reactor system.

19. The process according to any one of Claims 15 to 18 wherein the pressure of the gaseous reactants entering the first reactor zone are in the region of 20 bar to 200 bar.

20. The process according to any one of Claims 15 to 19 in which the motive force of gas compression is provided by high pressure steam generated within the plant by a steam turbine.

21. The process according to any one of Claims 15 to 19 in which the motive force for gas compression is wholly or in part provided by the cooling system in the second reactor zone.

22. The process according to any one of Claims 15 to 19 wherein the temperature of the gaseous reactants entering the first reactor zone are in the region of 180°C to 220°C.